4/25/00 Draft

Designing an Optimized Through-Delta Conveyance System
by Alex Hildebrand

Introduction

There is no perfect way to convey water that is surplus to the needs of the Delta and areas of origin across the Delta from the Sacramento River and other tributaries for export south of the Delta. However, we can develop a through-Delta system that is much better for all interests than what we have now. Furthermore, it can be designed to optimize the combined degree of benefit for all interests in a balanced manner. We can list concepts toward which we should strive and measures which can be analyzed and combined to achieve desired improvements. Some combinations of measures will provide more benefit for one interest and other combinations will favor other interests. The most appropriate balance to be struck among interests will be a political judgement, but each option should be developed and analyzed to assure that whatever the final choice is the option chosen will be technically sound.

Basic Assumptions

For the purpose of this memo it is assumed that

- The combined maximum export rate of surplus water by the CVP and SWP will be about 15,000 cfs.
- There will be state of the art screens in the intake to Clifton Court.
- The CVP intake will be moved to Clifton Court.
- The conveyance system must be capable of complying with all Delta standards including internal salinity and dissolved oxygen (DO) standards .
- The impact of the export facilities on South Delta inchannel water depth and circulation and salinity must be fully mitigated.
- There must be sufficient and substantially continuous water flow from the Sacramento River to the central Delta via the Mokelumne channels to avoid the loss of control of Delta inchannel water salinity that can otherwise occur when the Delta Cross channel is closed for more than a brief period.
- There will be three permanent, operable tidal barriers in the South Delta. Two will be at the temporary barrier sites in Old and Middle Rivers. The Grantline barrier will be near the west end of Grantline Canal instead of further east for reasons explained later. The barriers will be open during the flood tide for unimpeded passage of water, fish, and boats. They will be closed during the ebb tide but will have first class boat locks. They will be operated nearly all the time except during flood flows in order to provide the benefits described later for water depth, fish, water salinity and dissolved

oxygen. These operable barriers will be much more efficient than the temporary barriers in capturing and holding high tide water. A fourth operable barrier at the head of Old River can provide somewhat more fish protection during high VAMP flows.

Other Considerations

1) To the extent that the flow path of Sacramento water toward Clifton Court can be shifted to go through eastern Delta channels it will contain less bromide and salt. Cross flow through eastern channels may also help control DO in the downstream portion of the San Joaquin Ship Channel.

2) The CVP delivers a lot of salt that is dissolved in DMC water that is delivered to its westside service area. Several hundred thousand tons of this salt drains to the San Joaquin River each year in the absence of a valley drain. It then comes down the river and in the absence of South Delta barriers, it is drawn back to the CVP pumps and is reexported. This retention of salt in the overall system of river channels and export canals increases salinity in the South Delta and for all CVP contractors who depend on Delta exports including wetlands. When the CVP intake is shifted to Clifton Court, a majority of this drainage salt will be shifted to the SWP. Measures should be adopted to minimize the extent to which this drainage salt gets back to the South Delta and thence to either of the export pumps.

3) Conveyance facilities must not be allowed to interfere with the conveyance of flood flows from large and small tributary streams through the Delta to the Bay. All barriers and flow restricting structures must be capable of being opened with no restriction of flow during floods.

Measures to be analyzed and combined to provide an optimum through-Delta conveyance system

If we accept for the purpose of this memo the assumptions regarding facilities, operating requirements, and concepts discussed above we can then examine operating and additional facility measures which can work toward an optimized through-Delta system. We will start with the South Delta and work north because what we do in the south influences what is needed in the north.

I. South Delta Measures

The three tidal South Delta barriers, if operated most of the time can provide an array of benefits to fishery and other interests.

a) The tidal barriers will largely isolate South Delta channels east of the tidal barriers from the drawdown of water depth by the export pumps. This is particularly important because the proposed continuous intake through the new screens and into Clifton Court and the increase of maximum export rates will substantially increase the already serious loss of water depth during low tide in the absence of any one or more of the three barriers. This increase in drawdown dictates putting the Grantline barrier at the west end of the channel in order to protect diverters between the two sites. Dredging of channels west of the barriers will be required to compensate for local drawdown of water depth in those channels.

b) The barriers will result in unidirectional circulation and make it possible to comply with the internal salinity standards and the DO standard in these internal channels.

c) The operable tidal barriers will capture more water than is needed most of the time to meet local agricultural diversion needs. This excess water will therefore be tidally pumped out of the head of Old River into the San Joaquin channel during low river flows. This then provides an hydraulic barrier that keeps San Joaquin water and salt and fish and trash (crabs, hyacinth, etc.) from being drawn through Old River to the export fish screens. It forces the flow at Vernalis to keep on down into the Ship Channel instead of flowing into Old River. Adequate inflow to the Ship Channel is an essential component of measures to meet the DO standard.

d) By pumping extra water when needed through the barriers during the ebb tide with very low lift, fish friendly pumps, the flow into the Ship Channel can be further increased when necessary to make it both feasible and reasonable to meet the DO standard in the Ship Channel.

e) This also makes it possible to protect downstream anadromous fish migrants in the San Joaquin River during low river flows from being drawn to the pumps no matter when they migrate. Fish Agency biologists testified before the SWRCB that 30% of these migrants migrate before and after the April 15 to May 15 pulsed flows. They can be fully protected by the tidal barriers whenever they migrate during low flows. Even during San Joaquin River flows of several thousand cfs, most of the Vernalis flow is kept out of Old River by the barriers, thereby providing a substantial degree of protection. Under some flow conditions a barrier at the head of Old River can keep more water out of Old River than can the tidal barriers.

f) A problem with screening fish at Clifton Court is that the export pumping creates the equivalent of a dead end slough from the point of view of disposal of screened fish. Disposal of screened fish by relocation in

E-022729

trucks causes fish damage and dumps a high concentration of screened fish where they are attractive to predators. When water is flowing past the barriers and on into the San Joaquin it may be possible to convey those screened fish almost continuously into the west end of this flow, perhaps by a short pipeline, with less handling and a much lower concentration of fish.

g) We will continue to have drainage salt load in the river until there is a valley drain or equivalent. Since the barriers shunt the drainage salt load in the San Joaquin River into the central Delta instead of letting it flow directly to the export pumps, there is a decrease in salt load in the South Delta and a temporary increase in the salt load in the central Delta. However, the reexport of this salt load to the CVP service area is much reduced by the barriers. This reduces the salt load delivered to the service area and, therefore, reduces the salt load drained to the river. There will be a brief time delay in the reduction in river salt load, but the drainage salt load derives largely from groundwater in and near the root zone which is flushed every year. Central Delta diverters will, therefore, have a modest increase in the percentage of the San Joaquin salt load that reaches their diversions, but this will be offset by a reduction in the total San Joaquin salt load so that the salt load they divert should not increase.

h) If it is justified to screen local diversions in the South Delta channels, the barriers will, if operated at all times, reduce the amount of dredging needed to provide room for screens.

II. Measures to get Sacramento water to the central Delta.

As acknowledged in the beginning of this memo, it is essential to keep a fairly steady flow of water from the Sacramento River to the central Delta. However, the importance of screening this flow is significantly reduced by substantial improvement in screening and salvaging those Sacramento fish that arrive at Clifton Court. Furthermore, several measures can be considered for reducing the proportion of Sacramento fish that are entrained in the cross flow to the central Delta.

a) The Cross Channel gates could be opened during the flood tide and closed during ebb tide.

b) Positive fish screens or sonic or other behavioral devices could be used to reduce the density of fish in water flowing through the Cross Channel.

c) An operable flow restrictor or hydraulic barrier or positive fish screens or sonic or other behavioral devices could be put in Georgianna Slough so that it could also be operated to reduce the Sacramento fish flowing through that channel while still taking Sacramento River water to the central Delta.

d) If the above measures do not adequately protect fish after trial an augmentation of screen diversion into the central Delta such as the Isleton diversion should be considered as long as it is designed only as a component of a through-Delta system and is designed so that it can not become part of a peripheral canal.

III. Measures to shift the crossflow of Sacramento River water toward the east

Selective dredging, operable flow restrictors and even tidal barriers can be considered in the vicinity of Dead Horse Island and elsewhere to shift at least part of the cross-channel flow into the South Fork of the Mokelumne River and then further south. The quality of Sacramento water reaching the South Delta will be better if it comes down the South Fork of the Mokelumne and moves on southward east of Bouldin Island and Venice Island to Middle River and then cuts across through Victoria Canal to Clifton Court. It is unlikely that all of the crossflow can come this way, and the tidal flow in the San Joaquin Ship channel will tend to disperse it. However, even if only several thousand cfs are brought this way, there should be water quality benefits in the South Delta and for exports.

Conclusion

This memorandum does not pretend to cover all potential improvements or address all problems. For example, it does not address the manner in which shallow water habitat needs would be melded into the system, or how the efficacy of the system can be enhanced by restoring a salt balance and recirculating river flow in the San Joaquin Basin. Technical analysis of each potential measure is needed. However, it is hoped that the memo will lead to innovative thinking by others. Furthermore, the measures suggested in the memo are believed to deserve objective consideration.